Analysis on creasing and embossing of carton material

Structure

- Terms
- Approach
- Results
- Conclusion

Terms

- Based on preliminary tests some different materials were chosen which should be analyzed in more experiments.
- The aim of the analysis was to find a dependence between the properties of the material and the process properties during creasing and embossing.
- Thereby uncoated and refined material was compared.

Approach

- Preliminary test to chose the carton material
- Results: 5 different types of carton, each with 3 different area-related masses for the main experiments
  - Printocart GC1
  - Performa White GC1
  - Neocart GC2
  - Tambrite GC2
  - Triplex Gris GD2

Approach

- Properties of the material
  - Thickness
  - Area-related mass
  - Specific Volume
  - Interlaminar strength
  - Tensile strength in direction of rotation and cross direction
  - Flexural rigidity in direction of rotation and cross direction
  - Bursting strength on felt and wire side
  - Compressibility

Approach

- Process Properties
  - Embossing:
    - Embossing tools with a embossing height of 300 µm, 400 µm and 600 µm
    - visual comparison of the embossing results
    - Measuring of the embossing height
  - Creasing:
    - 4 different upper dies, 12 different die plates
    - Selection of the die plates in dependence on the thickness of the material
    - Creasing of the cartons in direction of rotation and cross direction and with the embossment on felt and wire side
    - Folding the creased material around felt side and wire side due to folding rules in packaging an bookbindery
    - Recording a folding curve which shows the folding force during folding of 130°
    - Assessment of the results and comparison of the maximum bending force

Approach

Laboratory die

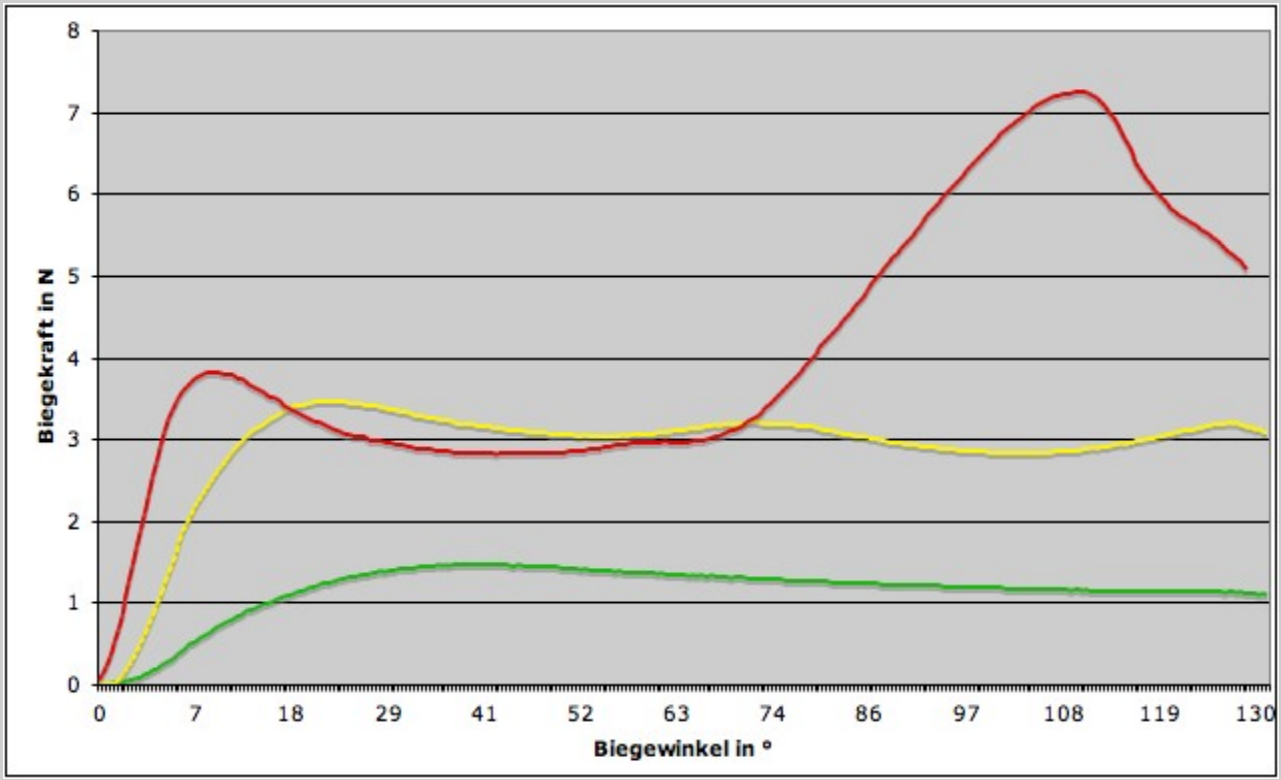
Company: „Marbach Stanzformtechnik“

Instrument to measure the bending force

Company: „Feinmechanik Kögel“

Approach

Assesment of the bending curves

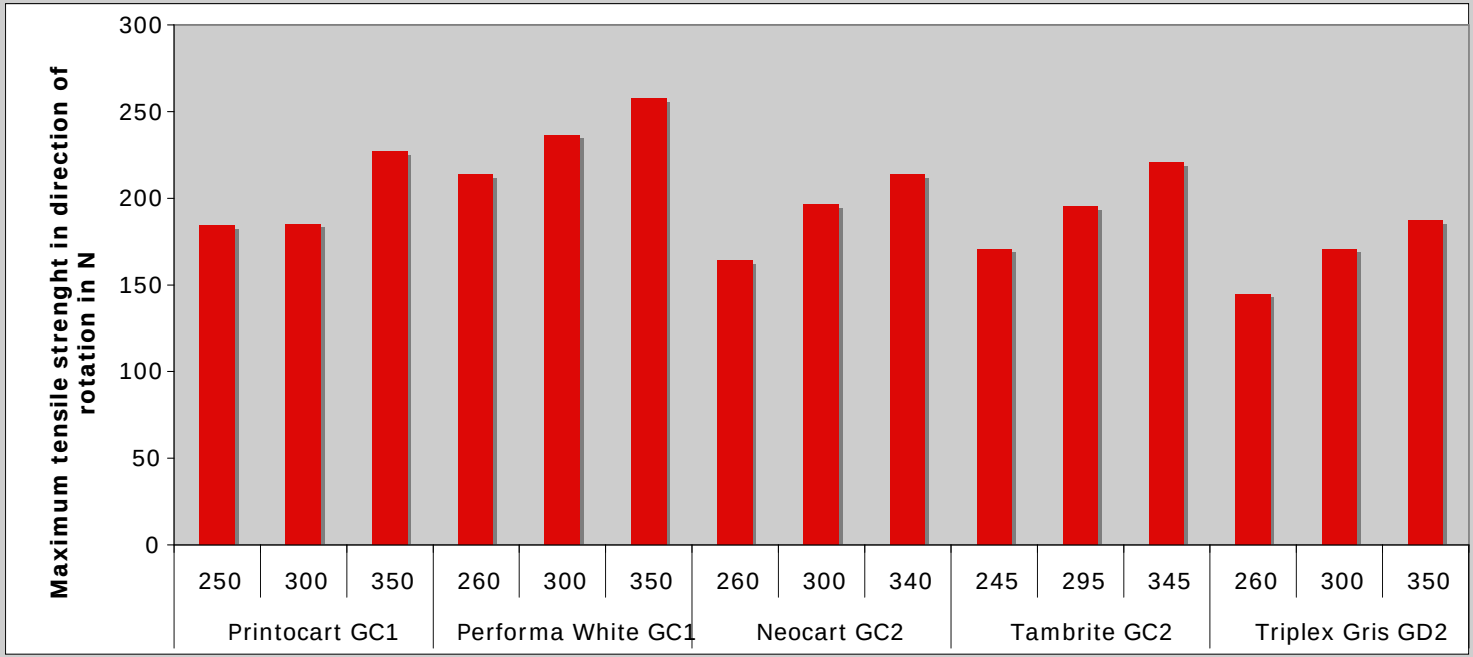


Results

1. The material properties of a carton are mainly influenced by the compounding of the material particularly the compounding of the fibres in the several layers and the thickness of the coating.

Results

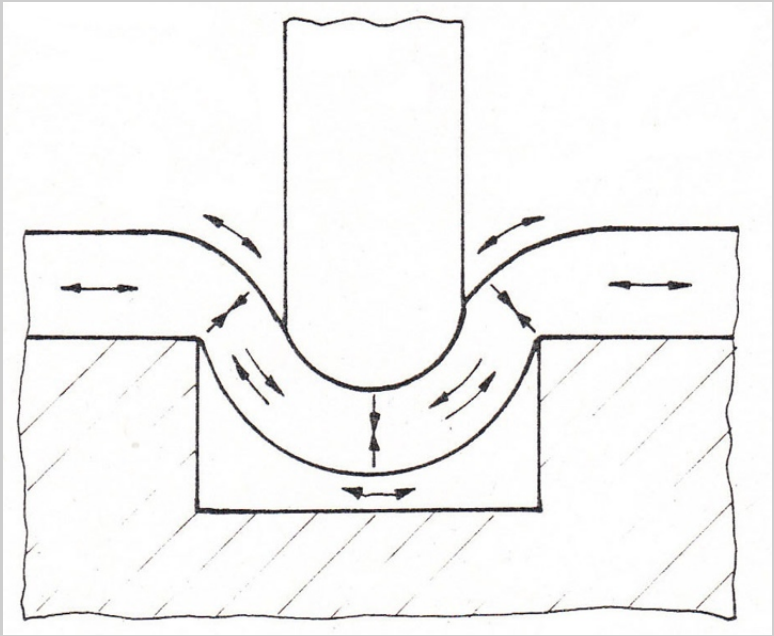
Example: Comparison of the different tensile strengths



Results

2. The process properties of a carton during embossing and creasing are dependent on the material properties specific volume, bursting strength, flexural rigidity, tensile strength, interlaminar strength and compressibility.

Results



Tensions during the processes:

- ↔ Tensile strength
- ⇻ Compression strength
- ⇆ Shear strength

Influenced by:

Tensile strength

Compressibility

Interlaminar Strength

Bursting strength

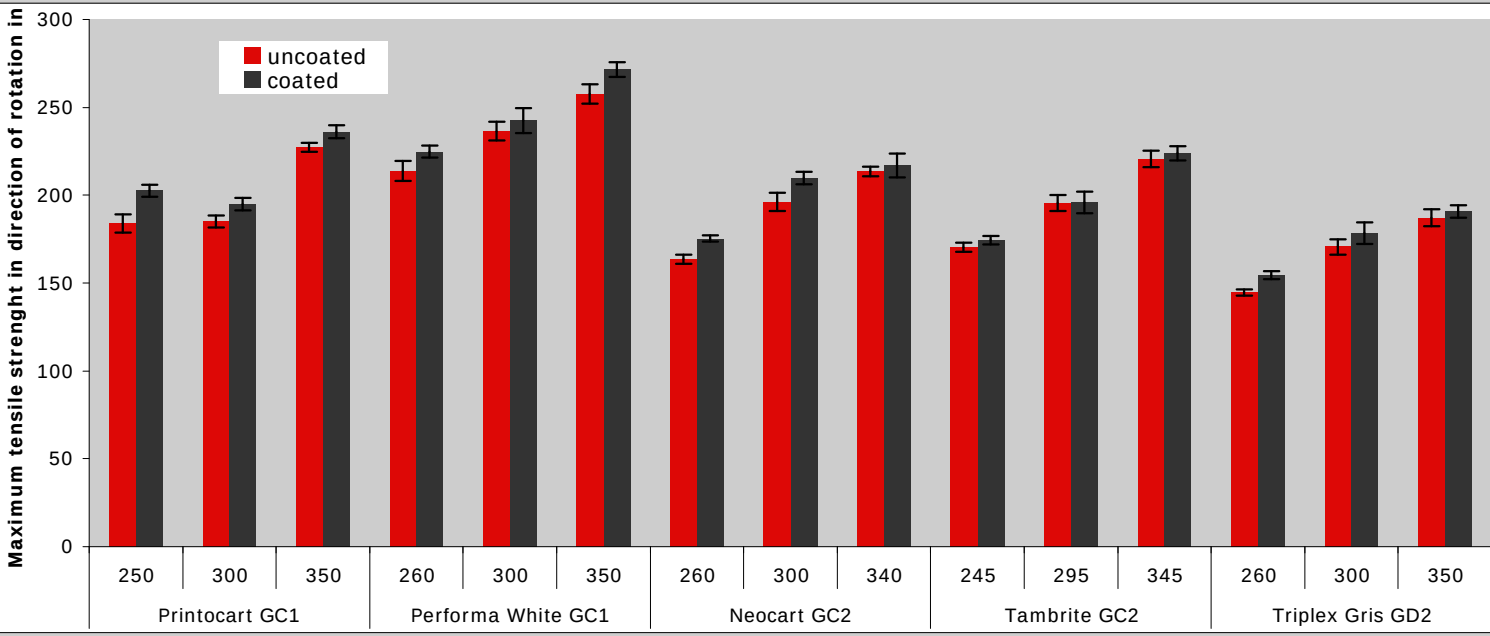
Flexural rigidity

Results

3. The coating changes the properties of the material and therefore the process properties of carton. The tensile strength, the bursting strength and the flexural rigidity are creasing when the material is coated with a foil. The interlaminar strength changes only slightly. The compressibility decreases slightly, because the material was already compressed during the coating.

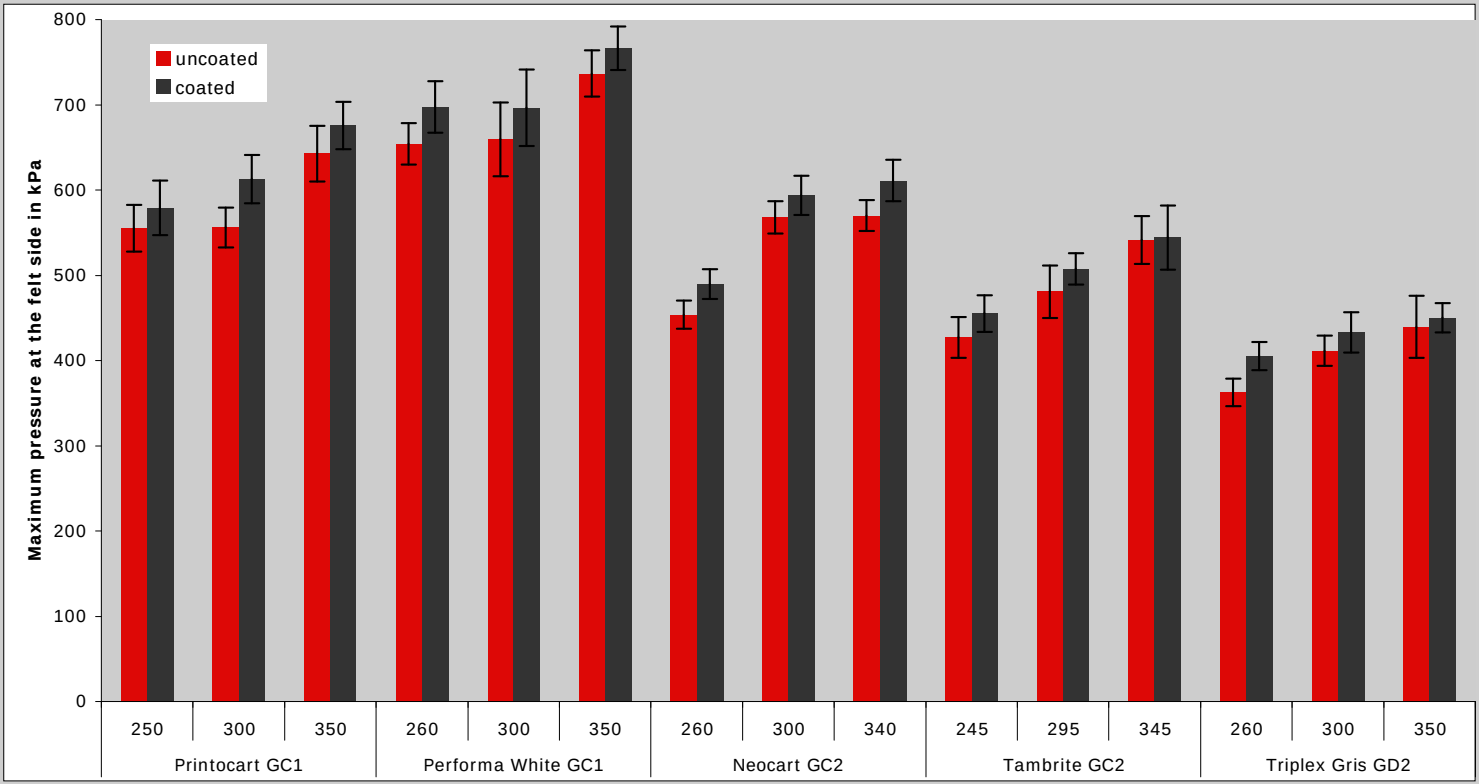
Results

Modification of the tensile strength



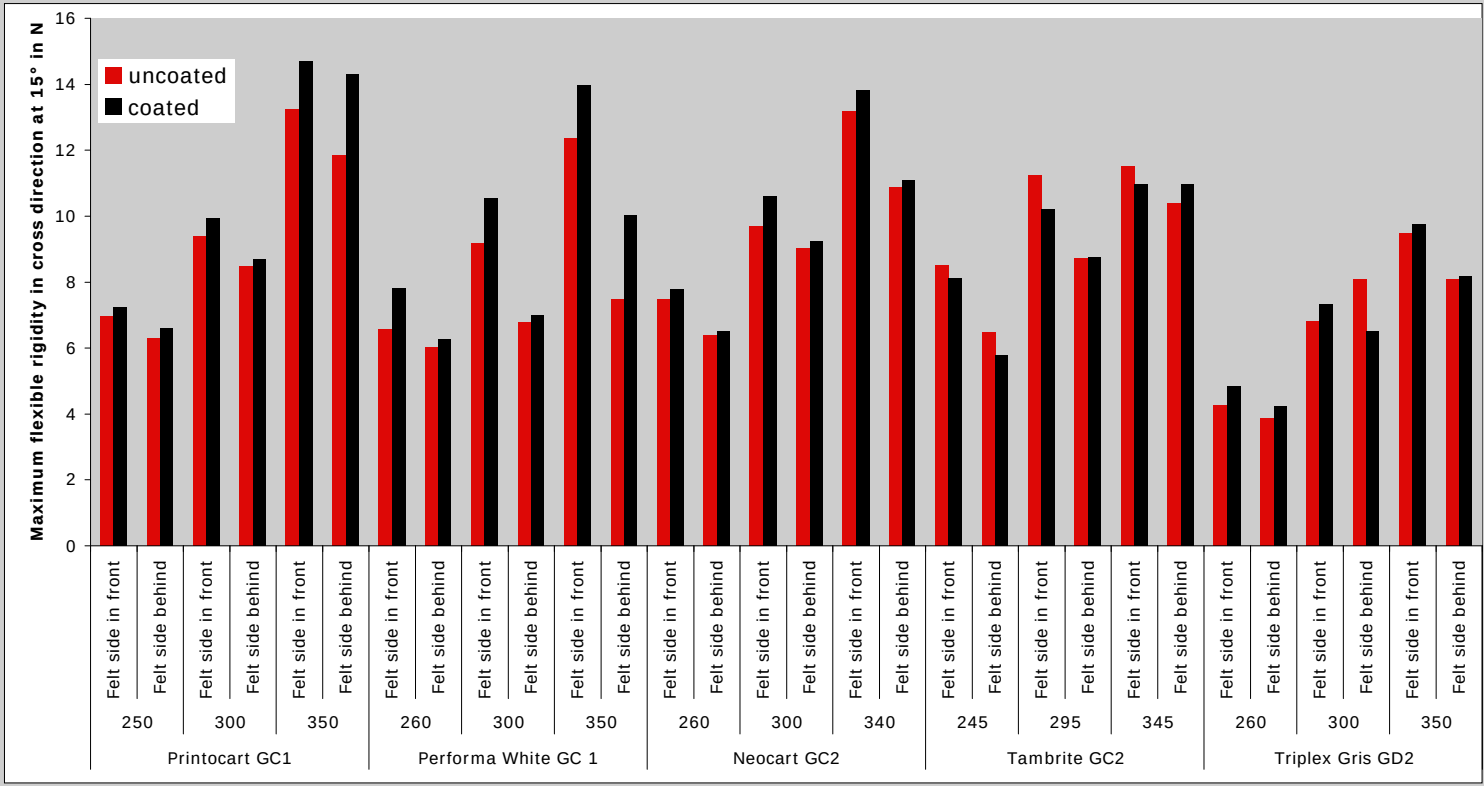
Results

Modification of the bursting strength



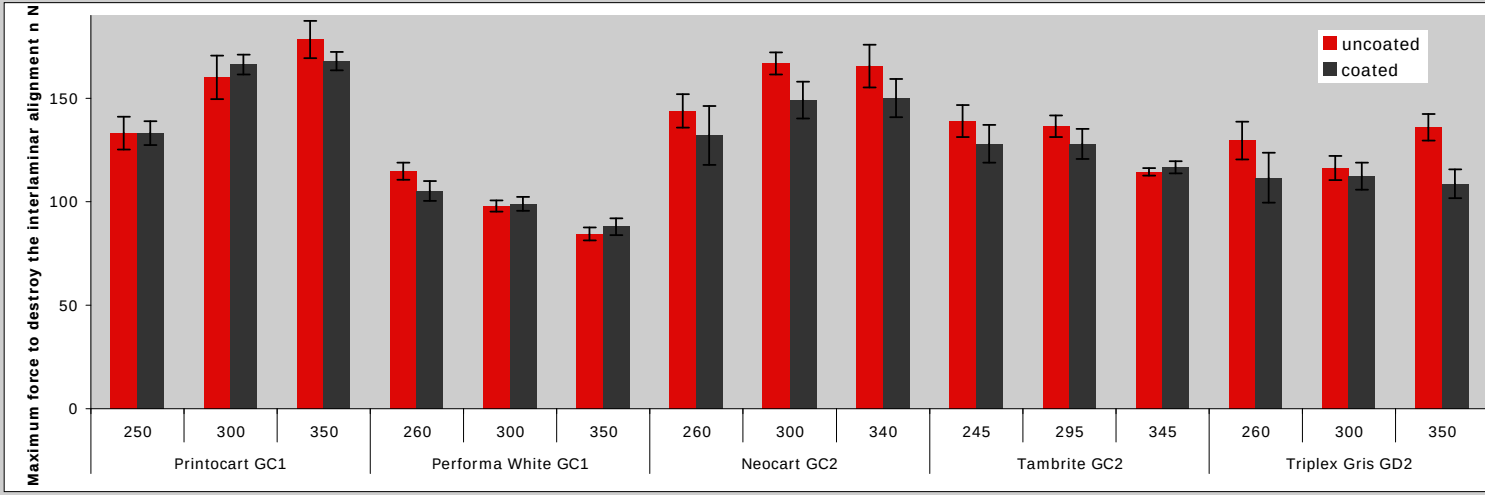
Results

Modification of the flexural rigidity



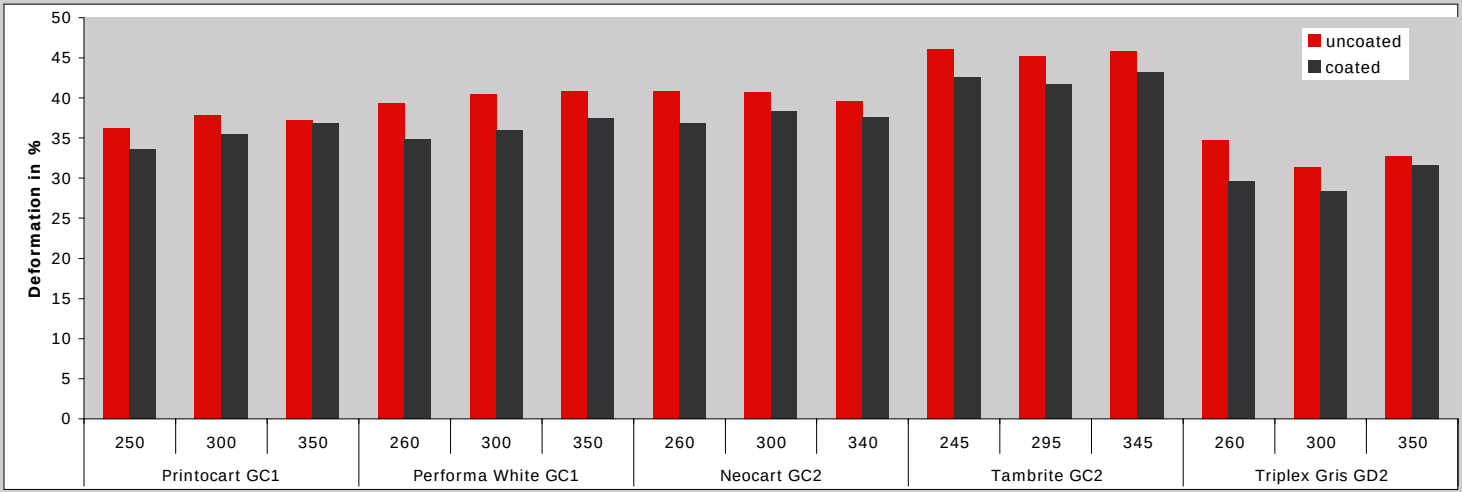
Results

Modification of the interlaminar strength



Results

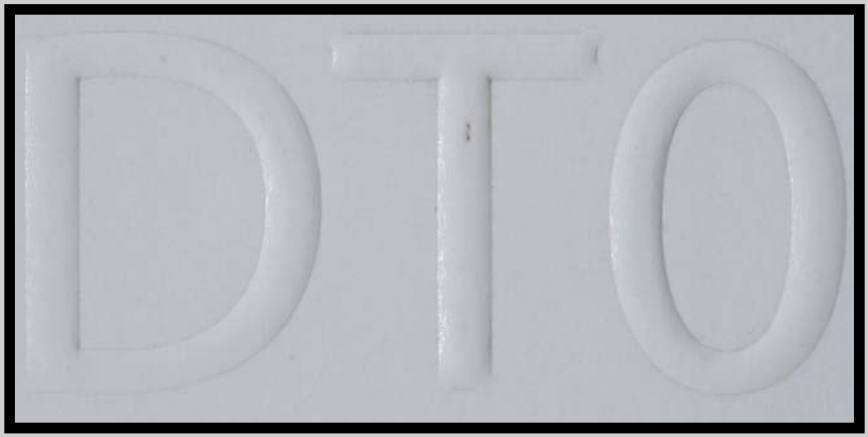
Modification of the compressibility



Results

4. When using the same embossing tools the embossing height of the uncoated material is higher than the embossing height of the coated material. Thus the motif is worse visible.

Results



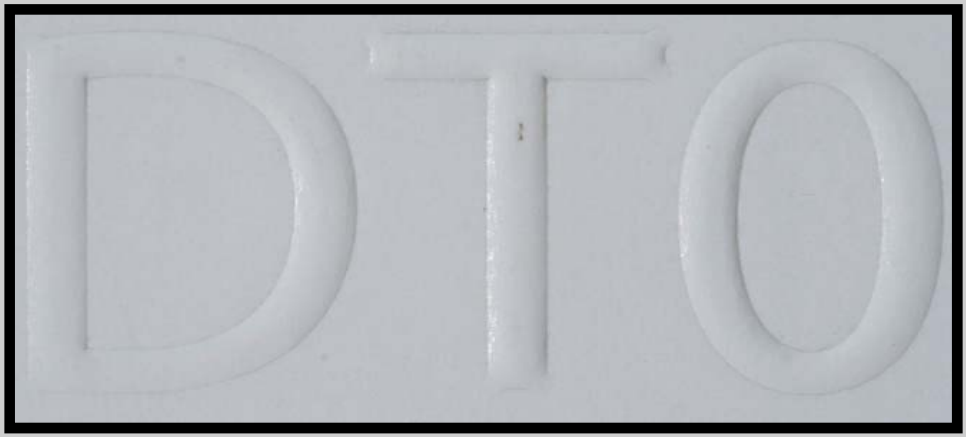
Performa White 260 uncoated,
Embossed with a height of 300 µm

Performa White 260 coated,
Embossed with a height of 300 µm

Results

5. A with foil coated carton could be embossed with 200 µm higher embossing heights before the material is damaged or the top coat is bursted.

Results



Performa White 260 uncoated,
Embossed with a height of 400 µm

Performa White 260 uncoated,
Embossed with a height of 600 µm

Resultss

Performa White 260 coated,
Embossed with a height of 400 µm

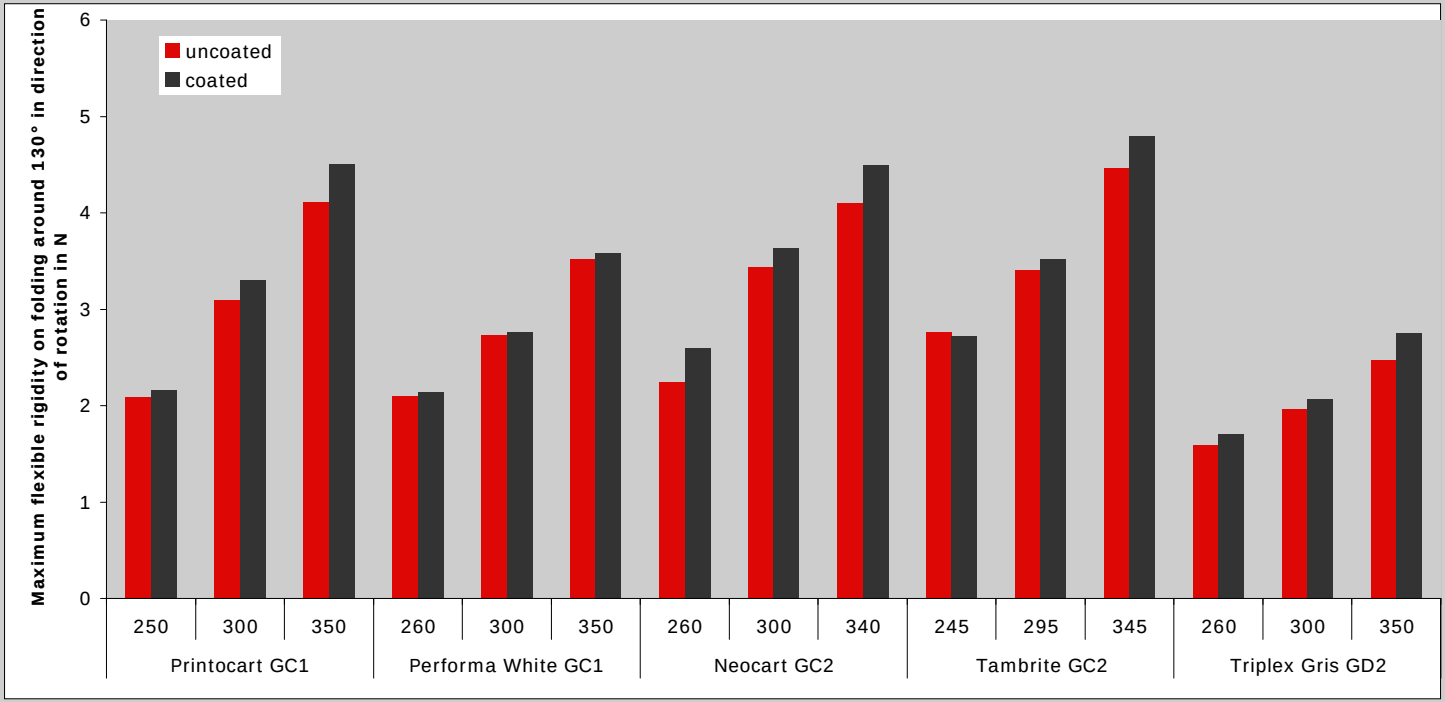
Performa White 260 coated,
Embossed with a height of 600 µm

Results

6. The depth of the creasing of a coated carton is lower. Therefore higher bending forces are necessary or the creasing must be deeper and smaller to gain the same appearance during the folding process.

Results

Modification of the bending forces after creasing



Results

7. Due to the fact, that carton is such a multifarious material in its compounding it was not possible to create a model that shows the dependence between uncoated and coated material.

Conclusion

The practice should always consider the given material properties and align the processes creasing and embossing with the carton.

Thank you for your attention!